



# Volunteer River Assessment Program Water Quality Monitoring Field Sampling Protocols - 2003

## VRAP Coordinator:

Ted Walsh  
6 Hazen Dr., P.O. Box 95, Concord NH 03302-0095  
(603) 271-2083 or 271-3503  
[twalsh@des.state.nh.us](mailto:twalsh@des.state.nh.us)

All VRAP equipment should be stored at room temperature (25°C / 77°F)

### **Equipment Checklist:**

Dissolved Oxygen (DO)/Temperature Meter  
Conductivity Meter  
Turbidimeter  
Kimwipes  
pH Meter and probe  
4.0 pH Buffer  
6.0 pH Buffer  
7.0 pH Buffer  
pH electrode storage solution  
pH electrode filling solution  
Oxygen meter extra membrane kit  
Sample container  
Deionized (DI) water and squeeze bottle  
Bucket, rope coil, cooler, ice packs  
Clip board and pencils (pencils will write in wet weather)  
Approximate elevation (in feet) of sampling locations  
Batteries (AA and 9V)

### **Optional Items:**

Warm, dry clothes and an extra set  
Bug spray  
Camera  
Snack and drinking water  
Trash bags  
Waders/boots/shoes that can get wet

Collect all the equipment and check the Equipment Maintenance Log to ensure the equipment has been properly maintained. **If it has not been maintained within 10 days of your sampling, do not use the kit.** Indicate on back of field sampling sheet if standards, solution, and batteries are fresh.

You are now ready to travel to your first sampling site. Start with the most downstream sampling location so that monitoring activities do not affect water quality at downstream sites.

**Calibration of the DO/temp meter and pH meter is required prior to each measurement.**

### **Calibration:**

Each meter has a very important calibration procedure, which **must** be followed to ensure the sampling results are as accurate as possible. If you run into problems during calibration refer to the operation manuals in the orange kit, or call the VRAP Coordinator.

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## Dissolved Oxygen / Temperature Meter Calibration Procedure:

The calibration procedure is applied prior to each individual dissolved oxygen/temperature measurement.

1. Turn the DO/Temp meter on by pressing the **ON/OFF** button. If necessary, press the **MODE** button until dissolved oxygen is displayed in mg/L or % air saturation.
2. To ensure the probe remains moist inside the DO/Temp meter calibration/storage chamber, pull the probe out and add ten drops of deionized (DI) water to the sponge at the bottom of the calibration chamber. Turn the meter on its side to allow any excess water to drain out of the chamber. This step will only be needed once per day, just be sure the sponge in the storage chamber is moist before storage.

The wet sponge creates a 100% saturated air environment within the chamber for ideal calibration conditions. Ensure that the DO sensor does not contact the wet sponge by inserting the probe only until the rubber seal is flush with the outer edge of the chamber.

3. Unscrew the black protective cage from the end of the probe and without any contact with the membrane surface, examine the tip (a white disc surrounded by a black circle) for any obvious air bubbles trapped beneath the membrane surface. If bubbles are detected, refer to the **Equipment Maintenance Procedures** sheet found inside the kit for instructions on membrane cap installation. Record the maintenance performed in the VRAP Equipment Maintenance Log located in the kit.
4. Replace the protective cage, rinse the probe and return it to the calibration chamber.
5. **Make sure the meter has been on for 15 minutes before calibrating.** Record on the upper right front page of the field data sheet the time the dissolved oxygen meter was turned on. If it has not, you may move on to calibration procedures for the other equipment.
6. Record on the upper right front page of the field data sheet the time of the first dissolved oxygen calibration.
7. Press and release both the **DOWN** and **UP** arrow buttons (**DOWN** arrow slightly prior to **UP** arrow) to enter the DO/Temp meter calibration menu. You will see **CAL** in the lower left corner when you have successfully entered calibration mode.
8. The screen will prompt you to enter the local altitude in hundreds of feet. Use the **UP** and **DOWN** arrows to adjust the reading appropriately (for example, entering a 12 indicates 1200 feet above sea level) and press **ENTER**.

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9. The screen will prompt you to enter the salinity of the samples you will be measuring. Be sure the screen reads zero and press **ENTER**. Then press **ENTER** again and the display should read “SAVE” and then return to normal measurement mode. **Record the calibration value displayed on the screen (typically 98.9%) on the Field Data Sheet. This number is located in the bottom right corner of the screen.** Watch to be sure that this number does not drift (i.e. goes from 98.9 % to 96.7% within a few minutes). If drift occurs first check the sponge in the chamber to ensure that it is saturated. Also check the condition of the membrane again and replace if air bubbles are present or the membrane is damaged.
10. **Leave the meter on until you are finished with all measurements for the day; calibration must be repeated before each measurement. If the meter shuts off, you must wait 15 minutes before calibrating.**
11. In rare cases you may measure the DO concentration of saline (salt) waters. If so, use the conductivity meter to determine the salinity before completing the DO/Temp Meter Calibration procedure. (Use the arrow keys to adjust the reading to the appropriate salinity and press **ENTER**.)

### **pH Meter Calibration Procedure:**

**The calibration procedure is required prior to each individual pH measurement.**

1. Unscrew the cap on the Electrode Storage Container and remove the end of the pH probe, the screw cap can remain on the electrode. Clean any salty deposits off by rinsing the probe with DI water. Blot dry.
2. If necessary, remove the blue plug from the hole in the side of the probe and refill the electrode with pH electrode filling solution (it may have spilled out). Fill to just below the hole, at least one inch above sample level. Return the blue plug to the hole in the side of the probe for storage and travel between sites. Remove the plug during calibration and sampling.
3. Shake air bubbles from the measurement end (opposite the wires), by gently tapping the outside of the probe against your finger.
4. Press the **POWER** key to turn the meter on. All the features of the display will light up. Then the model number, “210”, will be displayed. Once all power up procedures are complete the meter advances to “MEASURE” mode.

*For the first time operation, **or if any problems are encountered**, it is recommended that the Check Out procedure on page 11 of the Model 210A pH Meter Instruction Manual is carried out before using the meter.*

5. Select calibration mode by pressing the **MODE** key until “**CALIBRATE**” is displayed.
6. The last calibration standards, or “buffers”, used will be displayed (7-4). Press **YES** to accept this setting. “P1” will be displayed in the lower display field and the standard measurement will be displayed in the main display field. A black arrow will be displayed on the bottom of the screen pointing to 7 indicating that the meter is ready to measure the 7.0 buffer.
7. Rinse the electrode with deionized water and blot dry with a kimwipe.
8. Remove the blue plug from the side of the electrode and immerse the probe into the 7.0 buffer. Allow at least 1” of the filling solution volume inside the probe to remain above the sample and standard level during measurement/calibration.
9. When “**READY**” is displayed (Watch for it- it comes and goes quickly!) the electrode is stabilized. Press **YES** while “**READY**” is displayed.

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“P2” will be displayed in the lower display field- indicating the meter is ready for the second standard. Make sure “P2” appears before continuing, if it does not appear, keep the electrode in the 7.0 buffer until “READY” appears again and press **YES**. A black arrow will be displayed on the bottom of the screen pointing to 4 indicating that the meter is ready to measure the 4.0 buffer.

10. Remove the electrode from the 7.0 buffer, rinse it with deionized water and blot dry.
11. Place the electrode in the second (4.0) buffer. When “READY” is displayed press **YES**. **WATCH!**
12. “SLP” will appear in the lower display field and the current electrode slope will be displayed in the main field. Press **YES** to accept this value and record the number on your VRAP Field Data Sheet. An acceptable range for the slope is 92-102%. If you get a slope outside of this range repeat the calibration procedure and check the batteries. If the slope is still outside of the range do not use the meter for that day and notify DES immediately.
13. The meter will proceed to the measure mode; “MEASURE” is displayed above the main display field. Remove the electrode from the 4.0 buffer, rinse it with deionized water and blot dry. The meter is now ready for use.
1. Place the electrode **VERTICALLY** in the storage solution container, being careful not to hit the bottom of the container with the probe and screw the cap on the container. Secure the blue plug in the electrode and set the meter in the kit until you are ready to take a reading (remember, you will have to press the POWER key twice to restore power if a half hour or more has elapsed between calibration and sampling).

**Rinse the storage solution from the probe before any pH measurements and remember to calibrate between samples.**

## **Turbidimeter Calibration Procedure:**

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1. From the turbidimeter case (black, separate from orange kit) remove the standard vial marked “1.0 NTU” (if readings at this site tend to be greater than 8, use the “10 NTU” vial and note on data sheet) and carefully wipe off any water, dust and/or fingerprints with a kimwipe only.
2. Open the lid of the turbidimeter and align the etched arrow on the “1.0 NTU” tube with the arrow under the meter lid, insert the tube into the chamber and close the lid.
3. Push the **READ** button. A triangle should be displayed in the upper left corner of the display screen.

If the triangle is not displayed, turn the meter off by holding the **READ** button down until the screen reads **OFF**. Press the **CAL** button while pressing the **READ** button to turn the meter on. If the triangle does not appear, gently repeat step this step until it does. This step places the meter into “EPA mode”, which means the meter will automatically round readings to Environmental Protection Agency standards for uniform data reporting.

4. If the displayed value is the same as the 1.0 NTU Standard, calibration is not necessary at this time. Record “1.0” on the top left of the field data sheet as the initial turbidity calibration value.
5. If the displayed value differs from the standard value (1.0 NTU), record the value on the top left of the Field Data Sheet as the initial Turbidity Calibration Value, and push the **CAL** button until “**CAL**” is displayed. Release the button. The display will flash.
6. Adjust the reading with the up and down buttons, indicated with arrows, until the value of the standard is displayed.
7. Push the **CAL** button again to complete calibration.
8. Hold the **READ** button down until OFF is displayed on the screen to turn the meter off.

## Specific Conductance Meter Calibration Procedure :

*The YSI Model 30/30M looks much like the DO/Temp meter.*

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1. Turn the meter on by pressing the **ON/OFF** key. The meter will activate all segments of the display screen for a few seconds, followed by a self-test. If the meter is not functioning properly, a continuous error message will be displayed. See Section 9 of the meter manual for a list of error messages.
2. If the “°C” is not blinking on and off, press the **MODE** key until it does. This puts the meter into the temperature compensated mode.
3. Rinse probe with deionized water and blot dry.
4. Submerge the probe in the 200  $\mu\text{S}$  conductivity standard solution, and allow to stabilize for two minutes and record on the top left of the Field Data Sheet (Initial Specific Conductance Calibration Value). Be sure there are no air bubbles on or inside the probe. A reading of 175-225 $\mu\text{S}$  is acceptable. If the readings are outside of this range you can still take measurements but please contact the VRAP coordinator as soon as possible.
5. Rinse the probe, blot dry with a kimwipe, and return it to the storage chamber.

### **Quality Assurance and Quality Control (QA/QC):**



The VRAP Quality Assurance/Quality Control measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

1. **Calibration**: Prior to each measurement, the pH and DO meters must be calibrated. The turbidity and conductivity meters only need to be calibrated before the first measurement and after the last one.
2. **Duplicate analysis**: A second sample taken at the same time and site as the sample is collected and measured at one of the sites during the sampling day (not at the same site as the previous sampling date). Be sure to recalibrate the pH and DO meter before measuring the second sample.
3. **Replicate analysis**: A second measurement by each meter is taken from the same sample at one of the sites during the sampling day (not at the same site as the previous sampling date). Be sure to recalibrate the pH and DO meter before doing the second measurement.
4. **6.0 pH standard**: A reading of the pH 6.0 buffer is recorded at one of the sites during the sampling day (not at the same site as the previous sampling date). Record site, time, and reading on bottom of front page of field data sheet. Another calibration does not need to be done before this measurement as it is intended to detect drift in the meter
5. **DI Turbidity Blank**: A reading of the DI blank is recorded at one of the sites during the sampling day (not at the same site as the previous sampling date). Record site, time, and reading on bottom of front page of field data sheet.
6. **Post-calibration**: At the conclusion of each sampling day, all meters are calibrated according to the calibration steps listed above.

## Order of Field Tests: Important!

NOTE: Pour off water for laboratory test(s) before sampling field water quality

measurements.

**Turbidity**  
**pH**  
**Water Temperature**  
**Dissolved Oxygen**  
**Air Temperature**  
**Specific Conductance**

### **Collecting Samples for Field and Laboratory Analysis:**

**Please label all bottles *prior to filling them* with the date and time of collection, site name/number, collector's initials and the test(s) requested.**

#### **Offshore Sampling:**

1. Carefully wade out into the river until the flowing portion of the water is comfortably within arm's reach. Do not enter the water above your waist, and do not enter the water if there is any concern for your safety. Be sure to have someone on shore that knows where you are.
2. Position yourself facing upstream and rinse the bucket in the river three times. **Do not collect the water that is running over your legs/boots.** With the bucket facing upstream and held along side your body, slowly dip the lip of the bucket into the flowing water and allow the bucket to fill.

Rivers receive oxygen from the atmosphere through mixing. Just as riffles and rapids increase the oxygen in a river or stream, rushing water over the side of the bucket will add oxygen to the sample and yield inaccurate readings.

3. Carefully return to shore with the bucket  $\frac{1}{2}$  -  $\frac{3}{4}$  full and place it on the bank for immediate analysis.
4. If you are collecting samples for laboratory analysis, wade out into the river and collect water in a sterilized *E. coli* bottle (directions below, steps #5 and #6) and transfer the water to shore in a labeled and prepared bottle (some bottles contain acids that should not be released into the river). Preserve them properly (in a cooler on ice), and submit the

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samples to the laboratory within the sample holding time appropriate to each test (for more information, call NHDES Laboratory Services at 271-3445).

5. If the sample is to be analyzed for *E. coli*, wade out into the river, open a labeled, sterilized *E. coli* bottle and turn it upside-down before immersing it in the river. Be careful not to put your fingers or any other material on any surface on the inside of the bottle. Move the bottle from downstream to upstream as you fill the bottle. Dip the bottle into the river in a “U”-shaped scooping motion, turning the bottle right side-up at the bottom of the “U”. **Do not collect the water that is running over your legs/boots.**
6. Replace the cap on the bottle and carry the sample to shore. Preserve the bacteria sample properly (in a cooler on ice) and submit the sample to a laboratory within the sample holding time appropriate to the test (usually 6 hours).

### **Bridge Sampling:**

1. Lower the bucket from the upstream side of the bridge to the river and gather some water (doesn't have to be full). Pull the bucket up, swish the water around in the bucket to rinse and dump the water off the bridge. Repeat this process two more times.
2. Return the bucket to the river on the upstream side of the bridge and fill as slowly as possible (you may wish to weight the bucket).
3. Pull the bucket up and carry to a safe location (away from the road!) for analyses.
4. If you are collecting samples for analysis of additional parameters, pour water from your bucket into labeled bottles and preserve them properly (in a cooler on ice). Submit the samples to the laboratory within the sample holding time appropriate to each test (for more information, call NHDES Laboratory Services at 271-3445).

## **Field Tests:**

### **Turbidity**

1. Rinse the plastic sample container with deionized water. Then rinse the same container twice with a small amount of river water from the bucket. Pour sample water from the bucket into the plastic sample container (2/3 full) slowly to avoid adding bubbles to the

sample.

2. From the turbidimeter case remove the vial labeled “sample” or “S” and rinse it out with DI water. Rinse the vial twice with river water from the plastic sample container. Fill the vial with river water by carefully and slowly pouring the water down the side of the sample vial to avoid introducing any bubbles. Wipe any water, dust and/or fingerprints with a kimwipe.

**Any residue on the vials will interfere with an accurate turbidity reading. Anything other than Kimwipes may scratch the vials, causing inaccurate readings.**

3. Open the lid of the turbidimeter and align the etched arrow on the unmarked (sample) vial with the arrow under the turbidimeter lid, insert the tube into the chamber and close the lid.
4. Push the **READ** button. A triangle should be displayed in the upper left corner of the display screen.

If the triangle is not displayed, turn the meter off by holding the **READ** button down until the screen reads **OFF**. Press the **CAL** button while pressing the **READ** button to turn the meter on. If the triangle does not appear, gently repeat step this step until it does. This step places the meter into “EPA mode”, which means the meter will automatically round readings to Environmental Protection Agency standards for uniform data reporting.

5. Record the displayed turbidity reading on the field data sheet, and turn the meter off by holding the **READ** button down until the screen reads “OFF”. Remove the sample vial, empty it and rinse with deionized water.

The turbidimeter needs to be calibrated twice per sampling date (one prior to the first measurement and once after the last measurement. Please turn the meter off when not in use to conserve battery power.

6. At the end of the day, repeat calibration procedures and record on the Field Data Sheet and fill the sample vial with DI water.

## **Field Test:**

## **pH**

**pH meter must be calibrated prior to each pH measurement**

*If you are not analyzing for turbidity, please rinse the plastic container marked “sample” with deionized water. Rinse twice with a small amount of river water from the bucket. Pour sample*

*water from the bucket into the plastic “sample” container (2/3 full) slowly to avoid adding bubbles to the sample.*

1. **Calibrate the meter and record the slope on the Field Data Sheet.** Remove the probe and rinse with DI water. Avoid touching the measurement end of the probe and blot the plastic areas dry with a kimwipe.
1. After you have poured off water for turbidity analysis (if applicable), immerse the pH probe into the “sample” container and remove the blue plug from the side of the electrode. (Press the **POWER** key twice if the display screen has gone blank, this will occur if a half hour or more has elapsed since the last key was pressed.) The meter should be in the “**MEASURE**” mode. **Important: Do not let the electrode sit on the bottom of the sample container. Submerge the bottom two inches of the electrode and agitate by moving the electrode back and forth in the sample for a minimum of two minutes at approximately two inches per second for the pH reading to stabilize.**
3. Record the value displayed with the “**READY**” indicator on the field data sheet.
4. Rinse the probe with DI water and return it to the storage chamber containing electrode storage solution.
5. At the end of the day, follow calibration procedures and record the slope on the Field Data Sheet section for post-calibrations.

Make sure the electrode container is filled about half way with *pH Electrode Storage Solution* and ensure that the electrode is immersed in the storage solution. Be careful not to push the electrode against the bottom of the container as this could damage the electrode. Return the meter and the probe to the VRAP case. Set the probe upright, and be sure the blue cap is secured in the probe, even with a little masking tape. This will help preserve the equipment.

## **Field Test:**

### **Dissolved Oxygen, Water and Air Temperature**

**The DO meter must be calibrated prior to each DO measurement.**

2. Remove the DO/Temp probe from the calibration chamber and rinse the probe and cable (approximately 6 inches) with DI water. Blot dry with a kimwipe.

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3. Submerge the DO/Temp probe about 2/3 of the way into the large bucket and agitate by slowly moving the probe back and forth in the sample for a minimum of two minutes for the temperature and dissolved oxygen readings to stabilize. Some bouncing will occur due to the probes' sensitivity. Record the temperature (°C) and the DO (mg/L and % saturation) on the Field Data Sheet. (Press the **UP** arrow to shift from mg/L to %sat.)
4. Rinse the probe with DI water, blot dry and return it to the storage chamber. Wait two minutes and record the dissolved oxygen % saturation on the Field Data Sheet (Dissolved Oxygen/% saturation in chamber).
5. The DO/Temp meter should remain "on" until the last site has been tested and the meter has been calibrated following the last test. If the meter is turned off prior to the end of the sampling day, the meter must be turned on and allowed a 15-minute warm-up period prior to calibration and additional sampling.
6. To determine the air temperature (°C), carefully prop the DO/Temp probe up on top of the meter case (clean surface) and allow the temperature reading to stabilize (this should be done out of the direct sun). **It will only take a minute for the air temperature reading to stabilize. Do not leave the probe out of the chamber longer as it will damage the membrane.**
7. Rinse the probe with DI water before returning it to the calibration chamber.
8. At the end of the day, calibrate the meter and record the percentage in the post-calibration area on the back of the Field Data Sheet.

### Field Test:

### Specific Conductance

1. Press the **ON/OFF** key to turn the meter on. If the "°C" is not blinking on and off, press the **MODE** key until it does (this puts the meter into the temperature compensated mode). Rinse the probe with deionized water and blot dry.

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9. Immerse the probe in the sample and make sure it is deep enough to cover the hole in the side of the probe. **Do not allow the probe to touch any solid object or the bottom of the bucket while you are taking readings.** It is also important that there are no air bubbles on/in the electrode. To dislodge any bubbles, gently move the electrode through the water before recording the measurement.
10. Slowly move the probe back and forth in the sample for a minimum of two minutes for the temperature and conductivity readings to stabilize, record the conductivity reading on your field data sheet.
11. Rinse the probe, blot dry with a kimwipe, and return it to the storage chamber between measurements.
12. The specific conductance meter needs to be calibrated twice per sampling date (one prior to the first measurement and once after the last measurement. Please turn the meter off when not in use to conserve battery power.
13. At the end of the day, recalibrate the meter and record the standard value and error, if occurred, in the post-calibration section on the back of the Field Data Sheet.

## Post Calibration/End of Day Checklist

### Dissolved Oxygen Meter:

1. Calibrate the meter and record the calibration value displayed on the screen (typically 98.9%) on the back of the field data sheet.
2. Return the probe to the chamber with wet sponge and turn off the meter.

### ph Meter:

1. Calibrate the meter and record the pH calibration slope on the back of the field data

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sheet.

2. Turn off probe. Rinse the probe with DI water and blot dry. Insert the blue plug into the probe. Return the probe to the storage solution container. Store probe upright.

### **Turbidity Meter:**

1. Place the 1.0 NTU standard into the meter and record the displayed value on the back of the field data sheet.
2. Rinse the sample vial with DI water and fill with DI water for storage. Turn off meter.

### **Conductivity Meter:**

1. Rinse the probe with DI water, blot dry, and place in the 200 $\mu$ S standard. Record the displayed value on the back of the field data sheet.
2. Rinse the probe with DI water, blot dry, and return to chamber. Turn off the meter.

### **VRAP Kit:**

1. Remove used Kimwipes from the kit. Clean off any dirt and moisture.
2. Record any problems you have encountered on the back of the field data sheet and contact the VRAP coordinator.

**Remember:**

**Calibrate the pH and DO meter before each measurement!**

**Do not turn off the DO meter until the end of the day!**



Run duplicate and replicate samples once a day!

Test the pH 6.0 buffer and turbidity DI blank once a day!

Rinse everything a lot!!

*Most of all ~*

☒ Enjoy your field time!!! ☒